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The impact of board gender composition on dividend payouts☆

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A B S T R A C T

This paper investigates whether female independent directors are more likely to impose high dividend payouts. We find evidence that firms with a larger fraction of female directors on their board have greater dividend payouts. This finding is robust to alternative econometric specifications, and alternative measures of dividend payouts and female board representation. The positive effect of board gender composition on dividends remains when we employ propensity score matching, the instrumental variable approach, and difference-in-differences approach to address potential endogeneity concerns. Furthermore, we find that board gender composition significantly increases the dividend payout only for firms with weak governance, suggesting that female directors use dividend payouts as a governance device.

1. Introduction

Most of the finance literature that studies gender issues focuses on the effects of female board directors on firm value, performance (see e.g. Ahern and Dittmar, 2012; Dezso and Ross, 2012; Matsa and Miller, 2013) and risk taking (see e.g. Faccio et al., 2016). Nevertheless, there is an emerging literature which studies the impact of female directors and managers on specific corporate decisions. This literature tends to concur that female directors and managers have a significant impact on these decisions. For example, firms with female directors tend to focus more on corporate social responsibility (CSR) (Shaukat et al., 2016). They are also more likely to hire female top executives (Matsa and Miller, 2011) but less likely to downsize the workforce (Matsa and Miller, 2013). Further, they are less likely to make acquisition bids and tend to make acquisitions with lower bid premiums (Levi et al., 2014). Firms with female directors however spend more on research and development (R&D) (Miller and Triana, 2009). They also take out less debt and more generally make less risky financing and investment choices (Faccio et al., 2016). Finally, firms with female directors also differ in terms of the incentives of insider directors as reflected by greater pay-performance sensitivity as well as greater CEO turnover-performance sensitivity (Adams and Ferreira, 2009).

There is also evidence that female directors tend to change the boardroom dynamics. For example, female directors tend to be less conformist and they are also more vocal than their male counterparts (Carter et al., 2003; Adams and Ferreira, 2009; Adams et al., 2011). Further, the quality of boardroom discussions of complex decision problems is improved by the presence of female directors as the latter bring in different and sometimes conflicting points of view, thereby improving the information set available to the board (Miller and Triana, 2009; Gul et al., 2011). In other words, boards with female directors engage in more competitive interactions; and decision making is therefore less likely to suffer from groupthink (Chen et al., 2016; Janis, 1983). Importantly,

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Adams and Ferreira (2009) find that female directors are more likely to engage in monitoring. Not only are they more likely to attend board meetings than their male counterparts,[1] but they are also more likely to sit on the auditing, nomination and corporate governance committees, i.e., the monitoring-related board committees. Hence, there is mounting evidence that female directors focus more on monitoring than their male counterparts.

In turn, dividend policy has been argued to be a corporate governance device, and more specifically a means to mitigate Jensen's (1986) free cash flow problem. Rozeff (1982) is the first attempt at formalizing the corporate governance role of dividends. He argues that dividends reduce the free cash within the firm, thereby reducing the agency costs. However, dividends also increase transaction costs as they make the firm more reliant on expensive, external financing. Hence, there is an optimal dividend payout, which minimizes the sum of the agency costs and transaction costs. Similarly, Easterbrook (1984) argues that dividends fulfill a corporate governance role. In line with Rozeff (1982), he argues that a high dividend payout reduces the free cash flow available to managers. It is then the ensuing firm's reliance on external financing, which acts as a corporate governance device. More precisely, each time the firm returns to the capital markets to raise further funding, it subjects itself to the scrutiny of the market, including financial analysts, the press and institutional investors.

Linking the emerging evidence on the greater focus of female directors on monitoring to the corporate governance role of dividends, we hypothesize ceteris paribus that firms with (more) female directors have greater dividend payouts and that high dividend payouts are used as a monitoring device. We find strong support for this hypothesis for a sample of 1691 firms for the period of 1997–2011, amounting to 12,050 firm-year observations. We find a positive and statistically significant relationship between board gender composition and the level of dividend payout. Specifically, the coefficient estimate for our main variable of interest in the baseline model suggests that an increase of 10 percentage points in the fraction of female directors is associated with a 1.67 percentage point increase in the firm's dividend payout (the average dividend payout for the sample is 22.9%). This finding is robust to alternative econometric specifications, and measures of dividend payouts as well as an alternative measure of female board representation.

A methodological challenge for our study is the possibility that an omitted variable drives the effect of board gender composition on dividend payouts, thereby biasing our results. For instance, managers that are more responsive to investor demands for higher dividends may also be more responsive to calls for greater board diversity, rendering our results spurious. We use three identification strategies to address this concern and help establish causality. First, we apply propensity score matching to identify control firms without female directors, which are otherwise indistinguishable from our sample firms with female directors. The results suggest that there is a significant difference in dividend payouts between the two groups. Firms with female directors have significantly higher dividend payouts than the matched control group without female directors. This confirms our baseline results.

Our second identification strategy is to employ the instrumental variable (IV) approach and to use two-stage least squares (2SLS) regression analysis. We use two instrumental variables as a source of exogenous variation in the fraction of female directors on the board. Our first instrument, i.e., *Fraction of male directors linked to female directors*, which is also used in Adams and Ferreira (2009) and Levi et al. (2014), is defined as the fraction of male directors on the board who sit on other boards with at least one female director. The more connected a firm's male directors are to women, the more female directors should be expected on the firm's board, suggesting a positive relation between this instrumental variable and the fraction of female directors (Adams and Ferreira, 2009).

Our second instrument is *Female-to-male participation ratio*, which is constructed as the female labor force participation rate divided by the male labor force participation rate in a given state. The rationale behind this instrument is that firms in states where the female-to-male participation ratio is higher are more likely to find good female candidates for their directorships as they are able to tap into broader talent pools. Thus, the greater the female-to-male participation ratio, the greater should be the fraction of female directors on the board. Yet little evidence, if any, suggests that a firm's dividend payouts are correlated with the female-to-male participation ratio of that state. As expected, we find that both instruments are positively and significantly correlated with the fraction of female directors. The validity of the instruments is confirmed via the Cragg-Donald's Wald *F* weak-instrument test statistic. Importantly, the 2SLS results confirm the positive impact of board gender composition on dividend payouts.

Finally, we employ a difference-in-differences analysis and examine the changes in the dividend payout around female director appointments (the treatment group), compared with the changes in a matched sample of male director appointments (the control group). Matched firms are identified based on the propensity score method. We find that firms' dividend payouts are substantially higher for the year after a female director appointment than they are after a male director appointment. Overall, our identification tests suggest that female directors have a positive causal effect on dividend payouts.

In further analysis, we investigate whether a firm's governance affects the relationship between board gender composition and dividend payouts. We split the sample into strong and weak governance firms according to the Bebchuk et al. (2009) entrenchment index, CEO duality, CEO tenure, board independence, and product market competition. In addition, we split firms according to whether they operate in technology or non-technology industries. For the latter we expect the corporate governance role of the board of directors to be more important whereas for the former we expect the advisory role to be more important.[2] We also expect insider directors of non-technology firms to be more entrenched than those of technology firms (Anderson et al., 2000; Ittner et al., 2003). Hence, the effect of female directors on the dividend payout should be greater for non-technology firms than for technology firms. The results show a positive effect of female directors on dividends and this effect is highly significant (at the 1% level) in firms with weak governance (high corporate governance needs), but insignificant in firms with strong governance (low corporate governance needs). These findings provide support for our hypothesis that, compared to their male counterparts, female directors are more likely to use high dividend payouts as a monitoring device in weak governance firms as well as firms with high governance needs.

[1] Adams and Ferreira (2009) also find that the attendance of male directors improves in firms with female directors.

[2] See De Andrés and Rodríguez (2011). See also Chahine and Goergen (2013).

Our final set of tests examines whether firms with female directors are more or less likely to initiate dividends or reinitiate dividends following their omission. To the extent that a dividend initiation/reinitiation reduces agency costs of managerial expropriation or overinvestment (Rozeff, 1982; Easterbrook, 1984; Jensen, 1986), we expect that firms with more gender-diverse boards are more likely to initiate dividends as well as reinitiate dividends after an omission. Our findings using a Cox (1972) proportional hazard model are consistent with this prediction.

This paper makes two major contributions. Its main contribution is to the literature on board gender diversity as we provide strong evidence of a positive effect of female directors on dividend payouts. Our paper also makes a major contribution to the relatively sparse but growing research that links gender diversity to monitoring intensity (Adams and Ferreira, 2009; Gul et al., 2011). We find that boards with female directors are tougher monitors than all-male boards as reflected by the use of high dividend payouts as a monitoring device in firms with weak governance.

The remainder of the paper is organized as follows. Section 2 describes the data sources, sample selection, model specification, and summary statistics. Section 3 discusses the main results, robustness tests, and endogeneity issues. Section 4 examines whether the relationship between board gender composition and dividend payout is affected by various governance mechanisms as well as a measure for governance needs. Section 5 examines whether firms with female directors are more likely to initiate dividends and reinitiate dividends after an omission. Section 6 concludes.

2. Data sources, sample selection and methodology

2.1. Data sources and sample selection

Our sample is compiled from several sources. Director-level data is obtained from RiskMetrics, which provides director profiles for S&P 1500 companies including director name, age, title, gender, the year when the director began service, and committee membership, among others. Our period of study is 1997–2011. Data on dividends and other firm characteristics is from Compustat. Data on CEO characteristics is sourced from ExecuComp. Financial firms (SIC codes 6000–6999) are excluded. The final sample consists of 1691 firms or 12,050 firm-year observations for the period 1997–2011. All explanatory variables are lagged by one year to mitigate endogeneity concerns.

2.2. Empirical specification

To examine the impact of board gender composition on the dividend payout, we estimate the following baseline empirical model:

$$Dividend\ \ payout_{i,t+1} = \alpha + \beta \times Fraction\ \ of\ \ female\ \ directors_{i,t} + \gamma Z_{i,t} + Industry_i + Year_t + \varepsilon_{i,t} \tag{1}$$

The dependent variable is the dividend payout ratio, defined as dividends over net income. The findings are robust to alternative measures of dividend payout, including dividends over total assets, dividends per share, dividends over sales, and the dividend yield, i.e. the ratio of dividends per share to the fiscal year-end stock price. The main variable of interest is the fraction of female directors on the board. *Z* is a vector of control variables that affect a firm's dividend payout as evidenced by the extant literature. We shall specify *Z* below. $Industry_i$ represents industry-fixed effects based on the Fama and French 49-industry classification and $Year_t$ captures the year-fixed effects.

Z includes controls that account for the impact of firm characteristics on the dividend payout, following Leary and Michaely (2011) and Harford et al. (2008). *Ln* (*TA*) is firm size as measured by the natural logarithm of deflated total assets in 2009 dollars. *Leverage* is defined as the ratio of total debt (short- and long-term debt) to total assets. *Tobin's q*, a proxy for growth opportunities, is the ratio of book value of assets minus book value of equity plus market value of equity to the book value of assets. *Cash/net assets* measures cash reserves and is defined as cash and marketable securities divided by net assets (total assets minus cash and marketable securities). *ROA*, return on assets, is a measure for profitability. It is computed as earnings before interest, taxes, depreciation, and amortization divided by total assets. *Return volatility*, a proxy for business conditions, is measured as the standard deviation of the return on assets over the past five years. *PPE/TA*, a proxy for asset tangibility, is the ratio of net property, plant and equipment to total assets. *R&D/Sales*, i.e., the ratio of R&D to sales, is used as a proxy for financial distress costs. To mitigate the potential effects of outliers, all the above variables are winsorized at the 1st and 99th percentiles.

Hu and Kumar (2004) show that managerial entrenchment matters for dividend payouts. Thus, we include a variety of CEO-specific and board-related variables to capture the CEO's power and the quality of corporate governance. *Board size* is the number of directors on the board. *Fraction of independent directors* is measured as the number of independent directors divided by board size. *CEO Chairman* is an indicator variable equal to one if the CEO is the chairman of the board, and zero otherwise. *CEO tenure* is defined as the number of years the CEO has been in position. *E index* is the entrenchment index (E index) introduced by Bebchuk et al. (2009).[3] In additional tests, we include *CEO ownership* as an explanatory variable.

The table in Appendix A lists all the variables used in this study as well as specifying their definitions and data sources.

[3] The E index is based on the six provisions that set constitutional limits on shareholder voting power and strengthen the protection against takeovers that managers have. Of the six provisions, four set constitutional limits on shareholder voting power. They include: staggered boards, limits to shareholder amendments of the bylaws, supermajority requirements for mergers, and supermajority requirements for charter amendments. The two other provisions strengthen the protection that managers have against takeovers and they are poison pills and golden parachute arrangements. Each company is given a score, from 0 to 6, based on the number of these provisions that it has in a given year. The higher the index value the more entrenched managers are likely to be in the company (Bebchuk et al., 2009).

2.3. Descriptive analysis

Table 1 provides descriptive statistics on board gender composition and dividend paying firms. In more detail, it shows the number and percentage of firm-year observations with female directors as well as the number and percentage of firm-year observations with more than one female director. It also shows the number and percentage of firm-year observations with female independent directors and those of firm-year observations with female insider directors. Finally, the table also reports the number and percentage of firm-year observations associated with a dividend payment.

Panel A, which reports the numbers and percentages by year, shows that about two thirds of firms have female directors and this proportion is remarkably stable over time. In contrast, the percentage of firms with more than one female director increases steadily over the period of study, from just above 24% of firms in 1997 to slightly below 35% of firms in 2011. While the percentage of firms with female insider directors increases over time from about 5% in 1998 to 6% in 2011, it is important to highlight that the vast majority of female directors are independent directors and that the percentage of firms with female independent directors also increases over time from 62% in 1997 to 68% in 2011. This is in line with Adams and Ferreira (2009). Finally, similar to the trends reported by Fama and French (2001) and Baker and Wurgler (2004) there is a steady decrease in the percentage of dividend payers until about 2008. In 1997 dividend payers made up 79% of the sample firms whereas in 2008 this percentage had fallen to 54. In 2011, the percentage was up again with 63%.

Panel B shows the distribution of the firm-year observations across the 11 Fama-French industries (financial firms, forming the twelfth industry, are excluded).[4] There are marked differences across industries in terms of the percentage of firm-year observations with female directors. The percentage ranges from a low of 48.3% in Business Equipment to a high of 91% in Utilities. Business Equipment also has the lowest percentage of firm-year observations with more than one female director whereas Non Durables has the highest such percentage. There is also variation across industries in terms of the percentage of firm-year observations with female independent directors (ranging from 45.3% for Business Equipment to 88.4% for Utilities). More interestingly, there are only two industries – Non Durables and Telecom – for which the percentage of firm-year observations with female insider directors exceeds 10% (i.e., 10.9% and 13.6%, respectively). Finally, the two industries with the lowest percentages of firm-year observations with a dividend payment are Business Equipment (30.1%) and Healthcare (35.5%).

Table 2 reports summary statistics for the dependent and explanatory variables used in this study. The left-hand side of the table presents a comparison of firm-year observations with female directors and those without. There are consistently significant differences (all at the 1% level) between the two groups. In a nutshell, firm-year observations with female directors are associated with significantly higher dividend payouts. This is the case for all five measures of dividend payout, i.e., dividends over total assets, the dividend yield, the dividends per share, dividends over net income, and dividends over sales. Firms with female directors tend to be more mature firms as reflected by greater leverage, lower R&D over sales, lower return volatility and greater total assets value.

In contrast, the picture is somewhat mixed when it comes to the corporate governance characteristics. While firms with female directors tend to have a greater fraction of independent directors (74% versus 66%), they are also more likely to have duality of the CEO and chairman (66% versus 54%) and a higher entrenchment index (2.690 versus 2.339). Firms with female directors also tend to have larger boards, with on average 10 members compared to roughly 8 for firms without female directors. Conversely, they tend to have smaller cash reserves (as measured by cash over total assets).

A distinction is also made between dividend payers and non-payers on the right-hand side of the table. Overall, firms with dividend payments display firm and governance characteristics similar to those with female directors. For instance, analogous to firms with female directors, firms that pay dividends also tend to be more mature firms, and have higher leverage, lower R&D expenditures, less growth opportunities, lower return volatility, and greater tangible and total assets. In terms of the governance variables, dividend-paying firms have a greater fraction of independent directors, a higher entrenchment index, a larger board, and a higher incidence of CEO duality, but lower cash reserves relative to non-dividend-paying firms. Importantly, dividend payers have a greater fraction of female directors (12% versus 7.6%), especially female independent directors (10.9% versus 6.7%). The difference in the fraction of male independent directors (i.e., the number of male independent directors divided by the total number of independent directors on the board), however, is insignificant.

3. Board gender composition and dividend payout

3.1. Gender and dividend payout

Table 3 contains the results for the regressions explaining the dividend payout, as measured by dividends over net income. The six regressions not only vary in terms of how the fraction of female directors is measured, but also in terms of the control variables that are included. We start the analysis by regressing the dividend payout on the fraction of female directors, as well as industry and year dummies (regression (1)). In addition to the former variables, regressions (2) to (6) include various control variables. Regression (2) includes the firm characteristics as control variables. In addition to these, regression (3) includes the corporate governance variables (board size, the fraction of independent directors, the CEO Chairman indicator variable, CEO tenure, and the E index). Regression (6) also includes CEO ownership. Regressions (4) and (5) include the same control variables as regression (3), but use different measures for female representation on the board of directors. More specifically, regression (4) uses the weighted fraction of female directors with the weights being the tenure of each female director relative to the total board tenure, whereas regression (5) distinguishes between the fraction of female

[4] The reader should note that in the regression analysis we use the 49 (effectively 45) Fama-French industries.

Table 1
Sample details by year and industry.
Our final sample consists of an unbalanced panel of 12,050 firm-year observations for 1691 non-financial firms, which are in the intersection of the RiskMetrics, Compustat, and ExecuComp databases. This table describes the distribution of female directors and dividend policy across years (Panel A) and industries (Panel B). Panel A shows the number and proportion of firms which have at least one female director, more than one female director, at least one female independent director, at least one female insider director, and paying dividends in each year. Panel B describes the same information as Panel A but across the Fama-French 12 industries (financial firms being excluded).

Panel A: By year

Year	No. of obs.	No. of firm-year obs. with female directors	%	No. of firm-year obs. with more than one female directors	%	No. of firm-year obs. with female independent directors	%	No. of firm-year obs. with female insider directors	%	No. of firm-year obs. with dividends	%
1997	541	372	68.8%	132	24.4%	334	61.7%	25	4.6%	426	78.7%
1998	761	413	54.3%	132	17.3%	375	49.3%	23	3.0%	476	62.5%
1999	713	441	61.9%	162	22.7%	401	56.2%	28	3.9%	445	62.4%
2000	751	469	62.5%	167	22.2%	423	56.3%	35	4.7%	442	58.9%
2001	701	452	64.5%	164	23.4%	417	59.5%	35	5.0%	420	59.9%
2002	815	508	62.3%	187	22.9%	465	57.1%	46	5.6%	438	53.7%
2003	799	518	64.8%	197	24.7%	491	61.5%	39	4.9%	482	60.3%
2004	832	552	66.3%	216	26.0%	525	63.1%	36	4.3%	492	59.1%
2005	793	562	70.9%	232	29.3%	534	67.3%	36	4.5%	486	61.3%
2006	682	464	68.0%	205	30.1%	438	64.2%	29	4.3%	410	60.1%
2007	835	562	67.3%	235	28.1%	537	64.3%	44	5.3%	475	56.9%
2008	937	646	68.9%	298	31.8%	622	66.4%	53	5.7%	502	53.6%
2009	948	651	68.7%	305	32.2%	621	65.5%	53	5.6%	533	56.2%
2010	939	650	69.2%	315	33.5%	624	66.5%	60	6.4%	550	58.6%
2011	1003	709	70.7%	349	34.8%	682	68.0%	59	5.9%	627	62.5%
Total	12,050	7969	66.1%	3296	27.4%	7489	62.1%	601	5.0%	7204	59.8%

Panel B: By Fama-French 12-industry

Industry	No. of obs.	No. of firm-year obs. with female directors	%	No. of firm-year obs. with more than one female directors	%	No. of firm-year obs. with female independent directors	%	No. of firm-year obs. with female insider directors	%	No. of firm-year obs. with dividends	%
Non Durables	877	702	80.0%	452	51.5%	660	75.3%	96	10.9%	676	77.1%
Durables	351	225	64.1%	66	18.8%	212	60.4%	6	1.7%	258	73.5%
Manufacturing	1912	1164	60.9%	345	18.0%	1099	57.5%	59	3.1%	1423	74.4%
Energy	654	347	53.1%	102	15.6%	324	49.5%	7	1.1%	436	66.7%
Chemicals	529	431	81.5%	212	40.1%	417	78.8%	24	4.5%	466	88.1%
Business Eq.	2323	1123	48.3%	316	13.6%	1052	45.3%	72	3.1%	700	30.1%
Telecom	191	153	80.1%	93	48.7%	140	73.3%	26	13.6%	133	69.6%
Utilities	992	903	91.0%	490	49.4%	877	88.4%	25	2.5%	941	94.9%
Shops	1615	1193	73.9%	579	35.9%	1124	69.6%	159	9.8%	934	57.8%
Healthcare	1072	730	68.1%	270	25.2%	667	62.2%	64	6.0%	381	35.5%
Other	1534	998	65.1%	371	24.2%	917	59.8%	63	4.1%	856	55.8%
Total	12,050	7969	66.1%	3296	27.4%	7489	62.1%	601	5.0%	7204	59.8%

independent directors and the fraction of female insider directors. Regression (5) also includes the fraction of male independent directors as an additional control variable.

In all the above specifications, the coefficient on *Fraction of female directors* is positive and statistically significant at the 5% level or better. In terms of economic significance, the coefficient in regression (3) suggests that an increase of 10 percentage points in the fraction of female directors is associated with a 1.67 percentage-point increase in the firm's dividend payout. Importantly as regression (5) suggests, the effect of female directors on the dividend payout is driven primarily by female independent directors, as opposed to insider directors, and female independent directors have a greater impact on the dividend payout than do male independent directors.[5]

As stated above, regression (4) uses the tenure weighted measure, which allows for the possibility that directors with longer tenure (whether male or female) have a greater impact on dividend policy than directors with shorter tenure (Schwartz-Ziv and Weisbach, 2013). It could also be the case that the longer-tenured male directors appoint the female directors, which would likely reduce the impact of the latter on the dividend payout. Nevertheless, the tenure weighted measure confirms our previous results: a greater fraction of female directors results in a higher dividend payout and this positive effect is due to female independent directors rather than female insider directors (see regression (5)).[6]

Overall, there is strong and consistent evidence across all six regressions that the dividend payout increases with the fraction of female directors, independent of how the latter is measured. These results provide support for our main hypothesis that female directors are more likely to use high dividend payouts as a monitoring device than their male counterparts.

[5] The difference between the two coefficients is significant at the 5% level.

[6] In an untabulated regression, we include the tenure weighted fractions of female independent directors and female insider directors but exclude the fraction of male independent directors. The results are virtually identical to those of regression (5). Again, the fraction of female independent directors is significant at the 5% level, whereas the fraction of female insider directors is not significant.

Table 2
Summary statistics.
This table reports the means and standard deviations of the variables used in this study for the entire sample and for the subsamples of firms with and without female directors as well as the subsamples of firms with and without dividends. For each variable, the differences between the two subsamples are reported along with t-statistics based on the two-sample t-test. Appendix A contains a detailed definition of all the variables.

Variable	Whole sample		Firm-year obs. with female directors		Firm-year obs. without female directors				Firm-year obs. with dividends		Firm-year obs. with no dividend			
	N = 12,050		N = 7969		N = 4081				N = 7214		N = 4837			
	Mean	S.d.	Mean	S.d.	Mean	S.d.	Diff	t-stat	Mean	S.d.	Mean	S.d.	Diff	t-stat
Dividend/TA	0.014	0.021	0.016	0.021	0.008	0.019	0.008***	19.7	0.023	0.022	0.000	0.000	0.023***	70.011
DPS/Share price	0.014	0.019	0.017	0.019	0.007	0.015	0.010***	28.2	0.023	0.019	0.000	0.000	0.023***	83.975
Dividend per share (DPS)	0.450	0.598	0.582	0.642	0.194	0.387	0.388***	35.5	0.752	0.608	0.000	0.000	0.752***	85.999
Dividend/NI	0.229	0.459	0.280	0.486	0.128	0.384	0.152***	17.4	0.382	0.542	0.000	0.000	0.382***	49.021
Dividend/Sales	0.016	0.024	0.020	0.026	0.009	0.020	0.011***	23.5	0.027	0.026	0.000	0.000	0.027***	71.476
Fraction of female dirs	0.103	0.093	0.155	0.069	0.000	0.000	0.155***	140.0	0.120	0.090	0.076	0.090	0.044***	26.090
Fraction of female indep. dirs.	0.092	0.087	0.139	0.070	0.000	0.000	0.139***	130.0	0.109	0.085	0.067	0.083	0.042***	26.980
Fraction of female insider dirs.	0.006	0.027	0.009	0.033	0.000	0.000	0.009***	17.2	0.005	0.026	0.006	0.029	−0.001*	−1.838
Fraction of male indep. dirs.	0.620	0.152	0.600	0.138	0.659	0.171	−0.059***	−20.6	0.619	0.146	0.621	0.161	−0.002	−0.635
Leverage	0.219	0.165	0.239	0.157	0.180	0.172	0.060***	19.1	0.241	0.150	0.187	0.180	0.054***	17.861
R&D/Sales	0.048	0.227	0.036	0.138	0.073	0.337	−0.038***	−8.7	0.019	0.041	0.092	0.350	−0.073***	−17.522
Tobin's q	1.942	1.314	1.903	1.307	2.016	1.325	−0.113***	−4.5	1.819	1.116	2.124	1.546	−0.304***	−12.544
ROA	0.146	0.089	0.150	0.081	0.138	0.102	0.012***	6.9	0.156	0.074	0.131	0.105	0.024***	14.926
Return volatility	0.041	0.039	0.035	0.033	0.053	0.047	−0.017***	−23.7	0.030	0.028	0.050	0.045	−0.020***	−29.524
Cash/net assets	0.234	0.504	0.183	0.418	0.334	0.627	−0.151***	−15.8	0.137	0.279	0.379	0.694	−0.242***	−26.590
PPE/TA	0.312	0.234	0.328	0.232	0.281	0.235	0.047***	10.4	0.354	0.231	0.250	0.224	0.104***	24.425
TA ($m)	5727	10,643	7730	12,340	1816	3738	5914***	29.9	8011	12,675	2319	4818	5691***	29.818
Ln (TA)	7.520	1.488	7.935	1.465	6.710	1.164	1.225***	46.4	7.939	1.503	6.894	1.223	1.045***	40.251
Board size	9.282	2.377	10.070	2.244	7.743	1.807	2.328***	57.4	10.018	2.334	8.184	1.983	1.835***	44.877
Fraction of independent dirs	0.712	0.159	0.739	0.146	0.659	0.171	0.080***	26.8	0.728	0.155	0.687	0.162	0.040***	13.783
CEO Chairman	0.617	0.486	0.655	0.475	0.541	0.498	0.115***	12.3	0.680	0.467	0.522	0.500	0.158***	17.677
CEO tenure	8.120	7.359	7.260	6.345	9.801	8.777	−2.541***	−18.2	7.685	7.018	8.770	7.795	−1.086***	−7.959
E index	2.571	1.295	2.690	1.281	2.339	1.292	0.351***	14.2	2.648	1.307	2.457	1.269	0.191***	7.965**

* Denotes statistical significance at the 10% level.
** Denotes statistical significance at the 5% level.
*** Denotes statistical significance at the 1% level.

Moving onto the control variables, we find support for Rozeff (1982) and Easterbrook (1984) that dividends are used to disgorge free cash to shareholders in the absence of other such devices. Indeed, *Cash/net assets* has a positive and significant effect on the dividend payout in four of the five regressions that include this control variable. In contrast, leverage has a significantly negative effect on the dividend payout. Given that both debt and high dividend payouts are ways to mitigate Jensen's (1986) free cash flow problem, the negative sign on *Leverage* makes perfect sense (see also Benito and Young, 2003). The positive sign on *ROA* and the negative sign on *Return volatility* are also in line with the existing literature (Jagannathan et al., 2000).

Importantly, the corporate governance variables are all significant. *Board size* has a positive effect on the dividend payout.[7] In line with Hu and Kumar (2004), we find a positive effect of board independence on the dividend payout.[8] Again, this is in line with dividends being a monitoring device. We also find that duality increases the dividend payout. This is in contrast to Hu and Kumar (2004) who do not find any effect of duality on the dividend payout. *CEO tenure* has been argued to increase CEO power (see e.g. Finkelstein and Hambrick, 1989) and should therefore decrease the dividend payout. All four regressions, which include *CEO tenure* (i.e., regressions (3) to (6)), suggest that this is the case. Conversely, Hu and Kumar (2004) do not find that CEO tenure affects the payout.[9] Similar to CEO tenure, the entrenchment index also decreases the dividend payout.

3.2. Robustness tests

The robustness test results shown in Appendix C confirm that the positive effect of the fraction of female directors on the dividend payout persists when (i) a different measure is used for the dividend payout (i.e., dividends over total assets, dividend yield, dividends per share, and dividends over total sales); (ii) a different estimation technique is used (i.e., Tobit regressions, and Fama-MacBeth regressions); (iii) firm-year observations for Telecom, and Utilities are excluded; (iv) observations with female CEOs are

[7] The correlation between board size and firm size (total assets) is high with a value of 0.45 (see the correlation matrix reported in Appendix B). When we include just one of the two size variables at a time in the first four regressions from Table 3 (not tabulated), each of the two variables is positive and significant at the 1% level in all four regressions. In addition, we regress board size on firm size and then include the residuals from this regression as well as firm size in the first four regressions from Table 3 (the results are not tabulated). We find that both board size and firm size are now positive and significant at the 1% level across all four regressions. Since this strong correlation also concerns the robustness of our results, we revisit this issue in the robustness tests in Section 3.2.

[8] More precisely, Hu and Kumar (2004) find that board independence increases the dividend payout only if it exceeds 40%.

[9] Nevertheless, Hu and Kumar (2004) find that the CEO's length of service with the firm (which also includes the years spent with the firm before being appointed as the CEO) has a significant and positive effect on the dividend payout.

Table 3
Board gender composition and dividend payouts.
This table reports the results of the OLS regressions for the relationship between board gender composition and dividend payouts. The dependent variable is dividends over net income. Independent variables include the following. *Fraction of female dirs* (*Fraction of female dirs_tw*) is the equally-weighted (tenure-weighted) measure of the fraction of female directors on the board. *Fraction of female indep. dirs* (*Fraction of female insider dirs*) is the fraction of independent (insider) directors on the board, computed as the number of female independent (inside) directors divided by the total number of independent (insider) directors on the board. *Fraction of male indep. dirs* is the number of male independent directors divided by the total number of independent directors on the board. *Leverage* is the sum of short- and long-term debts to total assets. *R&D/Sales* is the R&D expenditures divided by total net sales. *Tobin's q* is the market value of equity plus total assets minus the book value of equity, all divided by total assets. *ROA* is earnings before interest, taxes, depreciation, and amortization divided by total assets. *Return volatility* is the volatility of ROA over the past five years. *Cash/net assets* is cash and marketable securities divided by net assets. *PPE/TA* is net property, plant and equipment divided by total assets. *Ln* (*TA*) is the natural logarithm of the deflated total assets in 2009 dollars. *Board size* is the total number of directors on the board. *Fraction of independent directors* is the number of independent directors divided by the board size. *CEO Chairman* is an indicator variable equal to one if the CEO is also the chairman of the board, and zero otherwise. *CEO tenure* is the number of years the CEO has been in position. *E index* is the entrenchment index of Bebchuk et al. (2009). *CEO ownership* is the percentage stock ownership of the CEO. Industry- and year-fixed effects are included in all the regressions. Industry effects are constructed based on the Fama-French 49-industry classification. Statistical significance is based on heteroskedasticity robust firm-clustered standard errors reported in parentheses.

	OLS regressions *Dependent variable: Dividend/NI*					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.351*	0.196	0.149	0.164	0.147	0.139
	(0.182)	(0.187)	(0.179)	(0.179)	(0.179)	(0.196)
Fraction of female dirs_{t-1}	0.404***	0.277***	0.167**	–	–	0.166**
	(0.069)	(0.071)	(0.069)			(0.070)
Fraction of female dirs_tw_{t-1}	–	–	–	0.172**	–	–
				(0.067)		
Fraction of female indep. dirs_{t-1}	–	–	–	–	0.253***	–
					(0.080)	
Fraction of female insider dirs_{t-1}	–	–	–	–	0.221	–
					(0.235)	
Fraction of male indep. dirs_{t-1}	–	–	–	–	0.108***	–
					(0.038)	
Leverage_{t-1}	–	−0.096**	−0.090**	−0.092**	−0.090**	−0.083*
		(0.044)	(0.043)	(0.042)	(0.043)	(0.043)
$\text{R\&D/Sales}_{t-1}$	–	−0.008	−0.015	−0.016	−0.015	−0.015
		(0.028)	(0.027)	(0.027)	(0.027)	(0.027)
Tobin's q_{t-1}	–	−0.003	−0.002	−0.002	−0.002	−0.001
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ROA_{t-1}	–	0.135**	0.126**	0.125**	0.126**	0.113*
		(0.064)	(0.063)	(0.063)	(0.063)	(0.064)
Return volatility_{t-1}	–	−0.693***	−0.680***	−0.678***	−0.684***	−0.685***
		(0.137)	(0.133)	(0.133)	(0.133)	(0.135)
Cash/net assets_{t-1}	–	0.023	0.029*	0.028*	0.029*	0.029*
		(0.014)	(0.015)	(0.015)	(0.015)	(0.015)
PPE/TA_{t-1}	–	0.061	0.066	0.067	0.067	0.057
		(0.048)	(0.046)	(0.046)	(0.047)	(0.047)
Ln $(\text{TA})_{t-1}$	–	0.024***	0.005	0.005	0.005	0.005
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Board size_{t-1}	–	–	0.019***	0.019***	0.019***	0.019***
			(0.003)	(0.003)	(0.003)	(0.003)
Fraction of independent directors_{t-1}	–	–	0.109***	0.107***	–	0.118***
			(0.038)	(0.037)		(0.039)
CEO Chairman_{t-1}	–	–	0.027**	0.026**	0.027**	0.024**
			(0.011)	(0.011)	(0.012)	(0.012)
CEO tenure_{t-1}	–	–	−0.002**	−0.002**	−0.002**	−0.002***
			(0.001)	(0.001)	(0.001)	(0.001)
E index_{t-1}	–	–	−0.011**	−0.011**	−0.010**	−0.011**
			(0.005)	(0.005)	(0.005)	(0.005)
CEO ownership_{t-1}	–	–	–	–	–	0.206*
						(0.115)
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
N	12,050	12,050	12,050	12,050	12,050	11,739
Adjusted R^2	0.115	0.124	0.132	0.132	0.132	0.131

* Denotes statistical significance at the 10% level.
** Denotes statistical significance at the 5% level.
*** Denotes statistical significance at the 1% level.

excluded as the monitoring hypothesis is unlikely to apply to female insider directors; (v) observations with female chair-CEOs are excluded; (vi) the square of the fraction of female directors is also included, thereby allowing for a non-linear relationship between the dividend payout and female board representation[10]; (vii) controlling for CEO pay-performance sensitivity; (viii)

[10] Note that the square of the fraction of female directors is only significant, and negative, when the dependent variable is the dividend yield. This regression suggests that the dividend yield increases with the fraction of female directors until the latter reaches 0.27, and then decreases.

controlling for other director characteristics, including average director age and tenure as well as director age and tenure diversity[11]; (ix) the board size and firm size variables are included one at a time; and (x) regressing board size on firm size and then including the residuals from this regression as well as firm size in the baseline dividend payout regressions.[12]

3.3. Identification

The challenge we face when attempting to identify a causal effect of female board representation on the dividend payout is the possibility of omitted variable bias. For example, managers that are more responsive to investor demands for higher dividends may also be more responsive to calls for greater board diversity. This would suggest that the fraction of female directors is endogenous. This section addresses these endogeneity concerns in the following three different ways. First, we conduct propensity score matching whereby firm-years with female directors are matched with firm-years without female directors, but with no significant differences in terms of all the other variables. Second, we employ an instrumental variable approach to adjust for the possible endogeneity of the fraction of female directors. Third, we also perform a difference-in-differences analysis that compares the changes in dividend payout around female director appointments to the changes in a matched sample of male director appointments.

3.3.1. Propensity score matching estimates

Table 4 compares the dividend payout (using various measures) and the dividend yield for firms with female directors with those for firms without female directors that have been matched via propensity score matching with the former. We first estimate the probability that a firm hires female directors. This probability (i.e., the propensity score) is the predicted value from a logit regression using the same controls as those included in regression (3) of Table 3. The logit regression results are reported in column (1) of Panel A of Table 4. Consistent with Adams and Ferreira (2009), we find that firms with female directors are larger and have better performance as measured by ROA. The pseudo R-square for the regression is high with a value of 0.301.

Next, we adopt the nearest neighbor approach to ensure that firms with female directors (i.e., the treatment group) are sufficiently similar to the matched firms without female directors (i.e., the control group). Specifically, each firm with female directors on its board is matched to a firm without female directors and with the closest propensity score. If a firm in the control group is matched to more than one firm in the treatment group, we retain only the pair for which the difference between the propensity scores of the two firms is the smallest.[13] We further require that the maximum difference between the propensity score of each firm with female directors and that of its matched peer does not exceed 0.1% in absolute value.[14]

To verify that firms in the treatment and control groups are indistinguishable in terms of observable characteristics, we conduct two diagnostic tests. The first test consists of re-estimating the logit model for the post-match sample. The results are shown in column (2) of Panel A of Table 4. None of the coefficient estimates is statistically significant, suggesting that there are no distinguishable trends in dividend payouts between the two groups. Furthermore, the coefficients in column (2) are much smaller in magnitude than those in column (1), suggesting that the results in column (2) are not simply an artifact of a decline in degrees of freedom in the restricted sample. Finally, the pseudo R-square drops substantially from 0.301 for the pre-match sample to 0.003 for the post-match sample. This suggests that the propensity score matching removes all observable differences other than the difference in the presence of female directors.

The second test consists of examining the difference for each observable characteristic between the treatment firms and the matched control firms. The results are reported in Panel B of Table 4. Again, none of the differences in observable characteristics between the treatment and control firms is statistically significant. Overall, the diagnostic test results suggest that the propensity score matching removes all observable differences other than the difference in the presence of female directors. Thus, this increases the likelihood that any difference in dividend payouts between the two groups is due to the presence of female directors on boards.

Finally, Panel C of Table 4 reports the propensity score matching estimates.[15] The results indicate that there are significant differences (all at the 1% level) in dividend payouts – for all five measures – between firms with female directors and those without. In detail, firms with female directors have greater dividends per share, dividends over total assets, dividends over net income, dividends over total sales, and greater dividend yields than the otherwise indistinguishable firms without female directors.

3.3.2. Instrumental variable approach

To address the endogeneity concern, we employ the instrumental variable approach to extract the exogenous component from board gender composition and then use it to explain the dividend payout. We use separately as well as jointly two different instrumental variables that capture a firm's likelihood of having female directors, but are uncorrelated with the dividend payout, except through the variables we control for. Our first instrument is the fraction of a firm's male directors who sit on other boards with at least one female director. This instrument is also used by Adams and Ferreira (2009) and Levi et al. (2014). The more connected a firm's male directors are to women, the more female directors should be expected on the firm's board (Adams and Ferreira, 2009). Thus, we expect this instrumental variable to be positively correlated with the fraction of female directors.

[11] Director age (tenure) diversity is calculated as the standard deviation of director age (tenure) divided by the average age (tenure) of all the directors on the board.
[12] See footnote 7 about the rationale behind (ix) and (x).
[13] As a robustness test we allow for control firms to be matched to multiple treatment firms. The results do not change qualitatively.
[14] Our results remain robust when we increase the maximum permissible difference in propensity scores to 1.0% and 0.5% in absolute value (untabulated).
[15] The difference in means between the treatment group and matched control group is the propensity score matching estimate of the average treatment effect on the treated (ATT).

Table 4
Propensity score matching estimator.
This table reports the propensity score matching estimation results. Panel A reports the parameter estimates from the logit model used to estimate the propensity scores. The dependent variable is an indicator variable set to one if there are female directors in the firm in a given year, and zero otherwise. Independent variables include the following. *Leverage* is the sum of short- and long-term debts to total assets. *R&D/Sales* is the R&D expenditures divided by total net sales. *Tobin's q* is the market value of equity plus total assets minus the book value of equity, all divided by total assets. *ROA* is earnings before interest, taxes, depreciation, and amortization divided by total assets. *Return volatilities* is the volatility of ROA over the past five years. *Cash/net assets* is cash and marketable securities divided by net assets. *PPE/TA* is net property, plant and equipment divided by total assets. *Ln (TA)* is the natural logarithm of the deflated total assets in 2009 dollars. *Board size* is the total number of directors on the board. *Fraction of independent directors* is the number of independent directors divided by the board size. *CEO Chairman* is an indicator variable equal to one if the CEO is also the chairman of the board, and zero otherwise. *CEO tenure* is the number of years the CEO has been in position. *E index* is the entrenchment index of Bebchuk et al. (2009) and it is constructed based on six provisions. Industry and year fixed effects are included in all regressions. Industry effects are constructed based on the Fama-French 49-industry classification. Statistical significance is based on the heteroskedasticity robust firm-clustered standard errors reported in parentheses. Panel A reports the pre-match propensity score regression and the post-match diagnostic regression. Panel B reports the univariate comparisons of firm characteristics between firms with and without female directors and the corresponding *t*-statistics. Panel C reports estimates of the average treatment effects. The dependent variables include dividends per share, dividends to total assets, dividend yield, the dividend payout ratio and dividends to total sales.

Panel A: Pre-match propensity score regression and post-match diagnostic regression

	Dependent variable: *Equals 1 if female directors are on the board and 0 otherwise*	
	Pre-match (1)	Post-match (2)
Intercept	−7.743***	0.341
	(1.276)	(1.200)
$Leverage_{t-1}$	−0.285	0.042
	(0.351)	(0.361)
$R\&D/Sales_{t-1}$	−0.134	0.006
	(0.285)	(0.330)
$Tobin's\ q_{t-1}$	0.038	−0.008
	(0.038)	(0.045)
ROA_{t-1}	1.237**	−0.225
	(0.597)	(0.619)
Return $volatility_{t-1}$	−2.379*	0.010
	(1.327)	(1.315)
Cash/net $assets_{t-1}$	0.104	−0.005
	(0.083)	(0.085)
PPE/TA_{t-1}	0.203	0.038
	(0.393)	(0.429)
$Ln\ (TA)_{t-1}$	0.399***	−0.024
	(0.052)	(0.058)
Board $size_{t-1}$	0.428***	0.012
	(0.032)	(0.032)
Fraction of independent $directors_{t-1}$	2.314***	−0.115
	(0.340)	(0.354)
CEO $Chairman_{t-1}$	0.250**	−0.058
	(0.099)	(0.108)
CEO $tenure_{t-1}$	−0.031***	0.002
	(0.007)	(0.007)
E $index_{t-1}$	0.082*	0.002
	(0.044)	(0.048)
Industry effects	Yes	Yes
Year effects	Yes	Yes
N	12,017	4836
Pseudo R^2	0.301	0.003

Panel B: Differences in firm characteristics

	Firm-year obs. with female dirs. ($N = 2418$)	Firm-year obs. without female dirs. ($N = 2418$)	Difference	*t*-stat
$Leverage_{t-1}$	0.195	0.196	0.000	−0.039
$R\&D/Sales_{t-1}$	0.055	0.054	0.001	0.275
$Tobin's\ q_{t-1}$	1.930	1.955	−0.024	−0.672
ROA_{t-1}	0.142	0.144	−0.002	−0.938
Return $volatility_{t-1}$	0.043	0.043	0.000	−0.066
Cash/net $assets_{t-1}$	0.287	0.286	0.001	0.063
PPE/TA_{t-1}	0.282	0.286	−0.004	−0.655
$Ln\ (TA)_{t-1}$	6.938	6.948	−0.010	−0.302
Board $size_{t-1}$	8.388	8.343	0.045	0.869
Fraction of independent $directors_{t-1}$	0.688	0.690	−0.002	−0.391
CEO $Chairman_{t-1}$	0.551	0.564	−0.013	−0.926
CEO $tenure_{t-1}$	8.866	8.868	−0.002	−0.011
E $index_{t-1}$	2.543	2.548	−0.005	−0.136

Table 4 *(continued)*

Panel C: Propensity score matching estimator				
Variable	Firm-year obs. with female dirs. ($N = 2418$)	Firm-year obs. without female dirs. ($N = 2418$)	Difference	*t*-stat
Dividend per share (DPS)	0.309	0.228	0.081***	6.390
Dividend/TA	0.011	0.009	0.002***	3.720
DPS/Share price	0.185	0.141	0.044***	3.520
Dividend/NI	0.011	0.008	0.003***	5.520
Dividend/Sales	0.012	0.010	0.002***	3.320

* Denotes statistical significance at the 10% level.
** Denotes statistical significance at the 5% level.
*** Denotes statistical significance at the 1% level.

Our second instrument is the female-to-male participation ratio, which is computed as the female participation ratio divided by the male participation ratio for the state where the firm is headquartered. The female (male) participation ratio is measured as the percentage of the civilian non-institutional population of the female (male) group in the civilian labor force. The data comes from the US Census Bureau website and is updated annually. The rationale for using this instrument is that firms in states where the female-to-male participation ratio is higher are more likely to find good female candidates for their board of directors, ceteris paribus, as they are able to tap into larger talent pools. Thus, we argue that the greater the female-to-male participation ratio, the greater should be the fraction of female directors on the board. Yet little evidence, if any, suggests that a firm's dividend policy is correlated with the female-to-male participation ratio of that state.

Panel A of Table 5 reports the results of the first-stage regressions where the dependent variable is the fraction of female directors. The explanatory variables include the above mentioned instruments and the same control variables as in regression (3) of Table 3. For brevity, we report only the coefficient estimates for the main variables of interest. Regression (1) uses the fraction of male directors linked to female directors as an instrument, regression (2) uses the female-to-male participation ratio, and regression (3) uses both instruments. Consistent with the rationale behind the instruments, the fraction of female directors is positively correlated to the fraction of male directors linked to female directors as well as to the female-to-male participation ratio. The coefficient estimates for the instruments in regressions (1) and (2) are statistically significant at the 1% level suggesting that our instruments are valid. In regression (3), the coefficients on the two instruments remain positive and statistically significant at the 1% level. The reported *F-statistics* are very high for all three regressions suggesting that none of our instruments is weak. Furthermore, the *p-value* of the Cragg-Donald's Wald *F* weak-instrument test statistic is 0.000 for all three regressions, again rejecting the null hypothesis that the instruments are weak (Cragg and Donald, 1993; Stock and Yogo, 2005).[16] The last test we conduct on the validity of our instruments is the Hansen (1982) *J* over-identification test in regression (3), which uses both instruments. The *p-value* indicates that the instruments are valid, i.e. uncorrelated with the error term.

Panel B of Table 5 reports the results for the second-stage regressions whose dependent variable is dividends over net income. The variable of interest is the variable with the predicted values of the fraction of female directors from the first-stage regressions. All three regressions confirm the significant (at the 1% level) and positive effect of the fraction of female directors on the dividend payout. This is consistent with our main hypothesis and suggests that our key result is not due to the endogeneity of the fraction of female directors.

There is some concern that our first instrument, the fraction of male directors linked to female directors, is a proxy for the connectedness of the board, which could be correlated with firm performance, and in turn dividend payouts. To address this concern, we follow Adams and Ferreira (2009) and use two more direct measures of board connectedness as additional controls: the total number of external board seats held by the directors and the total number of external board seats held by the male directors. The results are presented in Appendix D. The inclusion of these two more direct measures confirms our existing results.

Moreover, the fraction of male directors connected to female directors on other boards might be correlated with firm dividend policy through industry effects. We address this possibility in the following three ways. First, we exclude observations with directors sitting on the boards of their industry peer firms from the sample for the IV analysis (not tabulated). The results continue to hold. Second, we control for the following two variables (one at a time) that measure board connectedness in the same industry: the fraction of directors who sit on other boards in the same industry and the fraction of male directors who sit on other boards with a female presence in the same industry. The results are qualitatively similar to those reported when these variables are included. Finally, we consider a variation of the first instrument. This alternative instrument is defined as the fraction of a firm's male directors who (i) sit on boards with a female presence in other industries, and (ii) do not sit on other boards with a female presence in the same industry. We confirm that our results are not sensitive to this alternative definition of the instrument.

3.3.3. Difference-in-differences matching estimates

Our third identification strategy is to employ a difference-in-differences (DID) analysis around female director appointments to identify the effect of female board representation on the dividend payout. The DID approach compares the outcomes for two similar groups with and without the treatment but that would otherwise be subject to similar influence from the trending variables. Therefore, it increases the likelihood that any difference in the changes in outcomes before and after the treatment between the two groups is due to the impact of the treatment rather than the difference between the two groups prior to treatment.

[16] Panel A of Table 5 also shows the Stock and Yogo (2005) weak ID test critical values, which are for the Cragg-Donald Wald F-statistics. In all regressions, the *F-statistics* are much larger than their Stock and Yogo (2005) critical values based on 2SLS size. Therefore, we reject the null hypothesis that the instruments are weak.

Table 5
IV estimator.
This table presents estimates using the instrumental variables method based on two-stage least square (2SLS) panel regressions. Panel A presents the first-stage regression results where the dependent variable is the equally-weighted fraction of female directors. The instrumental variables are as follows. *Fraction of male directors linked to female directors* is the fraction of male directors on the board who sit on other boards with at least one female director. *Female-to-male participation ratio* is the ratio of the female labor force participation rate to the male labor force participation rate in a state for a given year. The estimated parameters of the other controls are not reported for brevity. Panel B reports the second-stage regression results. The dependent variable is the dividend payout ratio, calculated as dividends divided by net income. The same set of control variables, industry and year fixed effects as in our baseline models are included. Industry effects are constructed based on the Fama-French 49-industry classification. Statistical significance is based on the heteroskedasticity robust firm-clustered standard errors reported in parentheses. The Stock and Yogo (2005) weak ID test critical values are for the Cragg-Donald Wald F-statistics. A higher Cragg-Donald Wald F-statistic than the corresponding critical value indicates a rejection of the null hypothesis that the instrument(s) are weak.

Panel A: First-stage regressions

	Dependent variable: *Fraction of female dirs*		
Variable	(1)	(2)	(3)
Fraction of male directors linked to female directors	0.046***	–	0.044***
	(0.009)		(0.009)
Female-to-male participation ratio	–	0.224***	0.208***
		(0.058)	(0.058)
Controls	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes
N	11,860	12,011	11,821
F-statistic	27.150***	14.930***	20.060***
Cragg-Donald (CD) Wald F-statistic	127.150	85.670	100.500
Stock and Yogo (2005) weak ID test critical value	16.380	16.380	19.930
J-statistic for over-identification	–	–	1.950
p-value			0.163

Panel B: Second-stage regressions

	Dependent variable: *Dividend/NI*		
Variable	(1)	(2)	(3)
Intercept	0.390	0.589**	0.470*
	(0.245)	(0.298)	(0.258)
Fraction of female directors$_{t-1}$(Fitted)	2.328***	4.137***	3.064***
	(0.804)	(1.192)	(0.683)
Leverage$_{t-1}$	−0.095*	−0.090	−0.095*
	(0.049)	(0.061)	(0.053)
R&D/Sales$_{t-1}$	−0.009	−0.004	−0.006
	(0.025)	(0.026)	(0.025)
Tobin's q$_{t-1}$	−0.004	−0.006	−0.005
	(0.005)	(0.007)	(0.006)
ROA$_{t-1}$	0.068	0.026	0.049
	(0.081)	(0.108)	(0.090)
Return volatility$_{t-1}$	−0.542***	−0.424*	−0.494***
	(0.167)	(0.221)	(0.184)
Cash/net assets$_{t-1}$	0.020	0.013	0.017
	(0.016)	(0.018)	(0.016)
PPE/TA$_{t-1}$	0.079	0.095	0.083
	(0.050)	(0.062)	(0.054)
Ln (TA)$_{t-1}$	−0.018*	−0.037**	−0.026**
	(0.011)	(0.015)	(0.010)
Board size$_{t-1}$	0.007	−0.004	0.003
	(0.006)	(0.008)	(0.005)
Fraction of independent directors$_{t-1}$	−0.081	−0.245**	−0.145*
	(0.080)	(0.121)	(0.075)
CEO Chairman$_{t-1}$	−0.001	−0.023	−0.010
	(0.017)	(0.022)	(0.017)
CEO tenure$_{t-1}$	0.001	0.003	0.002
	(0.001)	(0.002)	(0.001)
E index$_{t-1}$	−0.014**	−0.018**	−0.016**
	(0.006)	(0.008)	(0.007)
Industry effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes
N	11,860	12,011	11,821

* Denotes statistical significance at the 10% level.
** Denotes statistical significance at the 5% level.
*** Denotes statistical significance at the 1% level.

Table 6
Difference-in-differences matching estimator.
This table reports the difference-in-differences matching estimation results. Panel A examines the differences in observable characteristics between firm-years with female director appointments and their matched controls in the pre-treatment year. Panel B reports the difference-in-differences estimates where the dependent variable is the dividend payout ratio, calculated as dividends divided by net income. The treatment group consists of firms that replace a departing male director aged above 60 with a female director and the control group consists of firms that replace a departing male director aged above 60 with another male director. We match treatment and control observations using propensity score matching. *Female appointment* is an indicator variable that equals one if the firm appoints a female director, and zero otherwise. *Post* is an indicator variable that equals one in the period after the appointment, and zero otherwise. The same set of control variables as in our baseline models is included. For the sake of brevity, we report only the coefficients on the main variables of interest. Industry effects are constructed based on the Fama-French 49-industry classification. Statistical significance is based on the heteroskedasticity robust firm-clustered standard errors reported in parentheses.

Panel A: Post-match differences

	Treatment	Control	Differences	*t*-statistics
Leverage	0.218	0.230	−0.012	−0.454
R&D/Sales	0.036	0.026	0.010	0.878
Tobin's q	1.763	1.644	0.119	0.761
ROA	0.135	0.129	0.005	0.415
Return volatility	0.036	0.030	0.006	1.246
Cash/net assets	0.212	0.215	−0.003	−0.061
PPE/TA	0.298	0.284	0.014	0.392
Ln (TA)	7.867	7.856	0.011	0.047
Board size	9.770	9.784	−0.014	−0.040
Fraction of independent directors	0.736	0.736	0.000	0.001
CEO Chairman	0.608	0.500	0.108	1.322
CEO tenure	6.419	5.689	0.730	0.765
E index	2.973	3.027	−0.054	−0.252

Panel B: Difference-in-differences estimator

	Dependent variable: *Dividend/NI*	
	(1)	(2)
Female appointment	−0.157**	−0.132
	(0.063)	(0.106)
Post	−0.235***	−0.186**
	(0.077)	(0.071)
Female appointment × Post	0.220***	0.150**
	(0.084)	(0.067)
All controls	Yes	Yes
Industry effects	Yes	No
Firm fixed effects	No	Yes
Year effects	Yes	Yes
N	296	296
Adjusted R^2	0.316	0.285

* Denotes statistical significance at the 10% level.
** Denotes statistical significance at the 5% level.
*** Denotes statistical significance at the 1% level.

The sample for this analysis includes firm-years one year before and one year after a director appointment, excluding the year of the appointment. To be included in the treatment group, a firm must appoint only one female director to replace a departing male director in the appointment year. We further require the departing male director to be older than 60 to ensure that the director turnover is less likely driven by unobserved factors, such as changes in corporate strategy.[17] The application of these criteria results in 74 female director appointments for our treatment group. For the control group, we identify 474 observations where a departing male director aged above 60 is replaced with one newly appointed male director.

We then match treatment and control observations using propensity score matching to ensure that the DID estimator is not driven by differences in CEO, firm or industry characteristics. The matching procedure is analogous to that described in Section 3.3.1.[18] Eventually, we obtain 74 pairs of matched firms. In Panel A of Table 6, we examine the differences in observable characteristics between firm-years with female director appointments and their matched controls in the pre-treatment year. The univariate comparisons indicate that no statistically significant differences exist in observable characteristics between the two groups. Based on this closely matched sample, we estimate the following panel regression.

$$\begin{aligned} &Dividend\ \ payout_{i,t} = \alpha + \beta_1 \times Female\ \ \text{appointment}_{i,t} + \beta_2 \times Post_{i,t} \\ &+\beta_3 \times Female\ \ \text{appointment}_{i,t} \times Post_{i,t} + \gamma Z_{i,t} + Industry_i + Year_t + \varepsilon_{i,t} \end{aligned} \tag{2}$$

[17] As a robustness check, we require the departing director to be older than 65, resulting in a more restricted sample of 57 matched pairs. The results continue to hold.
[18] We start the matching by estimating the probability, or propensity score, of a firm replacing a departing male director with a female director rather than a male director. We use the same explanatory variables as in the regressions in Panel A of Table 4. We then match each observation in the treatment group with the observation in the control group with the closest propensity score. To ensure that the observations in the treatment and control groups are sufficiently similar, we require the difference in propensity scores between the two groups to be less than 5% in absolute value.

Table 7
Board gender diversity, dividend payouts and corporate governance.
This table presents the OLS regression results separately for firms with different levels of managerial entrenchment. The six proxies for managerial entrenchment are as follows. *E Index* is the entrenchment index of Bebchuk et al. (2009). *CEO Chairman* is an indicator variable equal to one if the CEO also assumes the title of Chairman, and zero otherwise. *Tech* is an indicator variable equal to one for technology firms, and zero for non-technology firms. *CEO tenure* is the number of years the CEO has been in position. *Fraction of independent directors* is the number of independent directors divided by board size. *Four-Firm Concentration Ratio* is the fraction of a 5-digit NAICS industry's sales accounted for by its largest four firms and is a proxy for industry competition. Firms are split into high and low subsamples based on the sample median for a given variable. For example, a firm is included in the high *Product market competition* subsample if its value for *Four-firm concentration ratio* is below the sample median, and is included in the low competition subsample otherwise. In addition, a firm is in the high *E index*, *CEO tenure* and *Board independence* subsample if its *E index*, *CEO tenure* or *Fraction of independent directors* is above the sample median, and vice versa. Managers are considered to be more entrenched if the firm is a non-technology firm, has a high *E index*, high *CEO tenure*, low *Board independence*, or low *Product market competition*, or has a chairman CEO. The dependent variable is the dividend payout ratio, calculated as dividends divided by net income. The same set of control variables, industry and year fixed effects as in our baseline models are included. Industry effects are constructed based on the Fama-French 49-industry classification. Statistical significance is based on the heteroskedasticity robust firm-clustered standard errors reported in brackets.

	E index		CEO chairman		Industry		CEO tenure		Board independence		Product market competition	
	High	Low	Yes	No	Non-Tech	Tech	High	Low	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Intercept	0.288	−0.052	−0.075	0.777***	−0.013	−0.406***	−0.079	0.623***	0.024	−0.001	−0.072	0.341***
	(0.207)	(0.182)	(0.113)	(0.186)	(0.077)	(0.132)	(0.121)	(0.229)	(0.070)	(0.146)	(0.087)	(0.112)
Fraction of female dirs$_{t-1}$	0.286***	0.017	0.269***	−0.014	0.253***	0.405	0.279***	0.063	0.195**	0.145	0.229**	0.107
	(0.092)	(0.086)	(0.086)	(0.103)	(0.094)	(0.297)	(0.089)	(0.083)	(0.085)	(0.093)	(0.104)	(0.116)
Leverage$_{t-1}$	−0.002	−0.176***	−0.070	−0.103*	−0.022	0.179	−0.088*	−0.092	−0.135***	0.015	−0.024	−0.105*
	(0.056)	(0.058)	(0.056)	(0.058)	(0.059)	(0.128)	(0.051)	(0.058)	(0.052)	(0.061)	(0.077)	(0.060)
R&D/Sales$_{t-1}$	−0.076*	0.007	−0.026	−0.005	−0.122**	0.022*	−0.065*	0.014	−0.044	0.009	0.016	−0.106*
	(0.040)	(0.022)	(0.037)	(0.026)	(0.050)	(0.011)	(0.035)	(0.019)	(0.039)	(0.018)	(0.014)	(0.064)
Tobin's q$_{t-1}$	0.003	−0.003	−0.002	−0.001	−0.003	0.001	0.002	−0.005	−0.003	−0.001	−0.005	−0.004
	(0.006)	(0.004)	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)	(0.004)	(0.006)	(0.005)	(0.006)
ROA$_{t-1}$	0.041	0.194**	0.068	0.194**	0.164*	0.292**	0.039	0.191*	0.002	0.201**	0.165	0.143
	(0.086)	(0.085)	(0.083)	(0.091)	(0.089)	(0.133)	(0.085)	(0.098)	(0.082)	(0.087)	(0.105)	(0.120)
Return volatility$_{t-1}$	−0.730***	−0.606***	−0.666***	−0.696***	−0.946***	−0.199	−0.412**	−1.012***	−0.733***	−0.772***	−0.712***	−0.698**
	(0.187)	(0.177)	(0.194)	(0.157)	(0.177)	(0.236)	(0.178)	(0.194)	(0.173)	(0.197)	(0.195)	(0.284)
Cash/net assets$_{t-1}$	0.038	0.026*	0.030	0.032*	0.052**	0.043*	0.028**	0.033	0.054**	−0.001	0.006	0.065**
	(0.032)	(0.014)	(0.020)	(0.019)	(0.026)	(0.024)	(0.014)	(0.033)	(0.026)	(0.012)	(0.010)	(0.033)
PPE/TA$_{t-1}$	0.076	0.068	0.044	0.104	0.069	0.514***	0.055	0.074	0.277***	0.005	0.080	0.172**
	(0.065)	(0.055)	(0.058)	(0.068)	(0.050)	(0.162)	(0.061)	(0.059)	(0.050)	(0.070)	(0.079)	(0.068)
Ln (TA)$_{t-1}$	0.006	0.006	0.007	0.003	0.004	0.005	0.009	0.001	0.002	0.008	0.004	0.004
	(0.009)	(0.007)	(0.008)	(0.009)	(0.009)	(0.014)	(0.008)	(0.008)	(0.008)	(0.008)	(0.010)	(0.009)
Board size$_{t-1}$	0.020***	0.018***	0.019***	0.018***	0.027***	0.017**	0.016***	0.021***	0.019***	0.022***	0.018***	0.016***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.008)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)
Fraction of independent directors$_{t-1}$	0.159***	0.073	0.105**	0.103*	0.046	0.069	0.062	0.165***	0.097**	0.102	0.205***	0.051
	(0.054)	(0.048)	(0.048)	(0.054)	(0.057)	(0.078)	(0.047)	(0.053)	(0.048)	(0.133)	(0.054)	(0.057)
CEO Chairman$_{t-1}$	0.017	0.035**	–	–	0.041**	0.038	0.027*	0.026	0.030**	0.027	0.015	0.026
	(0.015)	(0.015)			(0.019)	(0.025)	(0.016)	(0.016)	(0.014)	(0.017)	(0.019)	(0.019)
CEO tenure$_{t-1}$	−0.002*	−0.002**	−0.002**	−0.001	−0.003***	−0.001	−0.002*	−0.002	−0.003***	−0.002	−0.002	−0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
E index$_{t-1}$	−0.016*	−0.021**	−0.010	−0.012*	−0.008	0.008	−0.004	−0.018**	−0.008	−0.011	−0.015**	−0.002
	(0.010)	(0.011)	(0.006)	(0.007)	(0.008)	(0.011)	(0.006)	(0.007)	(0.006)	(0.007)	(0.007)	(0.008)
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6351	5699	7430	4620	6313	1593	6371	5679	5837	6213	3729	3932
Adjusted R^2	0.129	0.141	0.132	0.121	0.054	0.135	0.135	0.136	0.097	0.154	0.103	0.156

* Denotes statistical significance at the 10% level.
** Denotes statistical significance at the 5% level.
*** Denotes statistical significance at the 1% level.

Table 8
Dividend initiation and re-initiation.
This table presents the Cox hazard regression results that predict the probability of dividend initiation and re-initiation following an omission, respectively. *Fraction of female directors* is the number of female directors divided by board size. The other control variables are the same as in previous tables. Industry effects are constructed based on the Fama-French 49-industry classification. Statistical significance is based on the heteroskedasticity robust firm-clustered standard errors reported in brackets.

	Initiation		Re-initiation	
	(1)	(2)	(3)	(4)
Fraction of female dirs$_{t-1}$	1.924**	1.704*	8.227*	46.683***
	(0.968)	(0.988)	(4.945)	(9.302)
Controls	No	Yes	No	Yes
Industry effects	Yes	Yes	Yes	Yes
N	3499	3499	275	213
Pseudo R^2	0.024	0.051	0.271	0.503

* Denotes statistical significance at the 10% level.
** Denotes statistical significance at the 5% level.
*** Denotes statistical significance at the 1% level.

where *Post* is an indicator variable that equals one if the year is after the director appointment, and zero otherwise. *Female appointment* is an indicator variable that equals one for firms in the treatment group, and zero otherwise.

Panel B of Table 6 reports the DID results using both OLS (regression (1)) and firm fixed effects (regression (2)). We include the same firm, governance and CEO controls as in regression (3) of Table 3. The coefficient on *Female appointment* × *Post* is positive and significant at the 5% level or better in both regressions. This suggests that, after female director appointments, firms have higher levels of dividend payouts than after male director appointments. For instance, the coefficient in regression (2) suggests that, on average, firms' dividend payouts are 15.0 percentage points higher for the year after the female director appointment than they are after the male director appointment.

One potential concern with the above analysis is that director appointments with changes in director types (i.e., replacing an insider director with an independent director, or vice versa) capture a firm's strategic changes that might influence its dividend payout. To mitigate this concern, we exclude director appointments with changes in director types before conducting the matching. As a result, the number of matched pairs drops to 57, and our findings continue to hold.

4. The role of corporate governance

In this section, we investigate whether the relationship between the fraction of female directors and the dividend payout is affected by a firm's corporate governance quality and needs. If firms with female directors are more likely to use dividend payouts as a governance device, then the positive effect of female directors on dividend payouts should be more prominent if the firm's governance is weak and/or if its governance needs are high.

Table 7 presents the regressions on the dividend payout for the subsamples of firms with strong and weak governance as measured by the level of managerial entrenchment (*E index*), and CEO-chairman duality (*CEO Chairman*). It also splits firms according to whether they operate in technology or non-technology industries. Again, for the latter we expect that the corporate governance role of the board of directors is more important whereas for the former we expect that the advisory role of the board is more important. We also expect insider directors of non-technology firms to be more entrenched than those of technology firms (Anderson et al., 2000; Ittner et al., 2003). Hence, we expect the effect of female directors on the dividend payout to be greater for non-technology firms than for technology firms. Regressions (1) and (2) present the results for the sample split into high and low managerial entrenchment firms, respectively, based on the sample median of *E index*. The positive relationship between the fraction of female directors and the dividend payout is statistically significant only for the above-median *E index* firms where managers are more likely to be entrenched. Regressions (3) and (4) present the results for the firms that combine the CEO and chairman roles and those that separate them, respectively. The results show that the coefficient on *Fraction of female directors* is positive and statistically significant only for the firms whose CEO is also the chairman of the board, consistent with the view that the dividend monitoring device is more important when the CEO is more powerful. Regressions (5) and (6) present the results for non-technology firms and technology firms, respectively.[19] As expected, the coefficient on *Fraction of female directors* is positive and highly significant (at the 1% level) for the non-technology firms, but insignificant for the technology firms.

[19] The definitions of technology firms and non-technology firms are as in Anderson et al. (2000), Ittner et al. (2003), Murphy (2003), and Chemmanur et al. (2013). Technology firms are defined as companies with primary SIC codes 3570 (Computer and Office Equipment), 3571 (Electronic Computers), 3572 (Computer Storage Devices), 3576 (Computer Communication Equipment), 3577 (Computer Peripheral Equipment), 3661 (Telephone & Telegraph Apparatus), 3674 (Semiconductor and Related Devices), 4812 (Wireless Telecommunication), 4813 (Telecommunication), 5045 (Computers and Software Wholesalers), 5961 (Electronic Mail-Order Houses), 7370 (Computer Programming, Data Processing), 7371 (Computer Programming Service), 7372 (Prepackaged Software), and 7373 (Computer Integrated Systems Design). Non-technology firms are firms with SIC codes below 4000, not otherwise categorized as technology firms.

Regressions (7) and (8) show that the fraction of female directors has a positive and significant effect on the dividend payout only for firms with above-median CEO tenure, reflecting the greater likelihood that the CEO is entrenched. In addition, high board independence and product market competition are associated with better corporate governance and more effective monitoring of managerial actions (Weisbach, 1988; Hart, 1983). Regressions (9) to (12) show that the relationship between the dividend payout and board gender composition is positive and statistically significant (insignificant) for the subsample of firms with low (high) governance quality as measured by board independence and product market competition (i.e., the four-firm concentration ratio).[20]

To summarize, our results consistently suggest that the quality of a firm's governance as well as its needs for governance affect the impact of female directors on dividend policy. The positive impact of board gender composition on dividend payouts is significant only for firms with weak governance as well as those with high governance needs, i.e., firms with high values for *E index*, firms with CEO duality, firms with high CEO tenure, low board independence, and low product market competition as well as non-technology firms. These findings lend further support to our hypothesis that female directors are more likely to use high dividend payouts as a monitoring device than their male counterparts.

5. Dividend initiation and re-initiation

To the extent that dividends reduce agency costs of managerial expropriation and overinvestment (Rozeff, 1982; Easterbrook, 1984; Jensen, 1986), we expect that firms with female board representation are more likely to initiate dividends. Accordingly, such firms should also be more likely to reinitiate dividends following an omission. We test these hypotheses using the following regression.

$$\begin{aligned}&\Pr(\mathit{Dividend\ \ Initiation/Re\text{-}initiation}) = \gamma_0 + \gamma_1 \times \mathit{Fraction\ \ of\ \ female\ \ directors}_{i,t} \\ &+\gamma_2 Z_{i,t} + \mathit{Industry}_i + \varepsilon_{i,t}\end{aligned} \tag{3}$$

We estimate the probability of dividend initiation or re-initiation using *Fraction of female directors*, as well as the same set of controls as in Eq. (1) (i.e., *Z*), and industry effects. Following Officer (2011), we define *Dividend Initiation* as the first non-zero dividend payment since the firm's first appearance in the CRSP database.[21] Firms that have initiated dividends before the first year of our sample period in 1997 are not included. As a result, the sample for this analysis consists of 691 firms (or 3499 firm-year observations), of which 166 have initiated a dividend payment over the period 1997–2011.

Similarly, we define *Dividend Re-initiation* as the first non-zero dividend payment following an omission. To identify re-initiations, we trace firms over the four years after an omission. Specifically, we restrict the re-initiation sample to firms that have (1) complete information on dividend payments from year $t-1$ to $t+4$ with year t being the year of omission, (2) a non-zero dividend payment in year $t-1$, and (3) a zero dividend payment in year t. We end up with 61 firms that have omitted their dividend, of which 24 have reinitiated within the four years after the omission, during the sample period.

We then estimate Eq. (3) using a Cox (1972) proportional hazard model, which flexibly accommodates for the fact that each firm's hazard rate, i.e., the probability that the firm initiates (re-initiates) dividend payments, is a function of the number of years following the first appearance in CRSP (a dividend omission) as well as the board gender diversity variable and the control variables. Table 8 presents the results. For the sake of brevity, we only report coefficient estimates for the gender diversity variable. With and without the inclusion of the control variables, the coefficient on *Fraction of female directors* is positive and statistically significant at the 10% level or better, consistent with the prediction that firms with female board representation are more likely to initiate dividends as well as reinitiate dividends after an omission.

6. Conclusion

Rozeff (1982) and Easterbrook (1984) were the first to suggest the corporate governance role of dividends whereby dividend payouts are a means to mitigate Jensen's (1986) free cash flow problem. Based on recent literature (e.g., Adams and Ferreira, 2009), which suggests that female independent directors increase the board's monitoring intensity, we hypothesize that boards with (more) female directors are more likely to use high dividend payouts as a corporate governance device. We find evidence in favor of our hypothesis as the fraction of female directors, more precisely the fraction of female independent directors, on the board is positively and significantly related to various measures of dividend payout. This finding is robust to alternative econometric specifications, as well as alternative measures of female board representation. The identification tests, using propensity score matching, the instrumental variable approach and a difference-in-differences analysis (DID), show that the results are not due to endogeneity issues.

Further analysis of the heterogeneity of the positive relationship between female directors and dividend payout suggests that the effect is significant only in firms with weak governance and high governance needs. Finally, we find that firms with female directors are more likely to initiate dividends as well as re-initiate dividends following an omission. These findings are consistent with the hypothesis that female directors are more likely to use dividend payouts as a monitoring device than their male counterparts.

[20] The four-firm concentration ratio is the fraction of a 5-digit NAICS industry's sales accounted for by its largest four firms and is a proxy for industry competition. A firm is included in the high competition group if its four-firm concentration ratio is below the sample median, and vice versa.

[21] The results are qualitatively similar when we define dividend initiation as the first non-zero dividend payment since the firm's first appearance in the Compustat database.

Appendix A. Definition of variables

Variables	Definitions	Source
Dividend payout measures		
Dividend/NI	Dividends over net income.	Compustat
Dividend/TA	Dividends over total assets.	Compustat
Dividend yield	Dividend per share divided by the fiscal year-end share price.	Compustat
Dividend per share	Dividend per share.	Compustat
Dividend/Sales	Dividends over total sales.	Compustat
Measures of board gender diversity		
Fraction of female dirs	The number of female directors on the board divided by board size.	RiskMetrics
Fraction of female indep. dirs	The number of female independent directors divided by board size.	RiskMetrics
Fraction of male indep. dirs	The number of male independent directors divided by board size.	RiskMetrics
Fraction of female insider dirs	The number of female insider directors divided by board size.	RiskMetrics
Fraction of female dirs_tw	The weighted fraction of female directors with the weights being the tenure of each female director relative to the total board tenure.	RiskMetrics
Control variables		
Leverage	The sum of short- and long-term debts divided by total assets.	Compustat
R&D/Sales	R&D expenditure divided by total sales.	Compustat
Tobin's q	Market value of equity (the product of fiscal year-end closing stock price and number of shares outstanding) plus total assets minus the book value of equity, all divided by total assets.	Compustat
ROA	Return on assets, computed as the earnings before interest, taxes, depreciation, and amortization divided by total assets.	Compustat
Return volatility	Time-series standard deviation of ROA over the past five years.	Compustat
Cash/net assets	Cash and marketable securities divided by net assets. Net assets are computed as total assets minus cash and marketable securities.	Compustat
PPE/TA	Net property, plant and equipment divided by total assets.	Compustat
Ln (TA)	Log of total assets in constant 2009 dollars (based on US GDP deflator from the Federal Reserve Economic Data).	Compustat
Board size	The total number of directors on the board.	RiskMetrics
Board independence	The number of independent directors divided by board size.	RiskMetrics
Board age	The average director age on the board.	RiskMetrics
Age diversity	The standard deviation of director age divided by the average director age on the board.	RiskMetrics
Board tenure	The average director tenure on the board.	RiskMetrics
Tenure diversity	The standard deviation of director tenure divided by the average director age on the board.	RiskMetrics
CEO Chairman	An indicator variable, which takes the value of one if the CEO is also the chairman of the board, and zero otherwise.	ExecuComp
CEO tenure	The number of years the CEO has been in position.	ExecuComp
E index	An index, defined by Bebchuk et al. (2009), and based on six antitakeover provisions. The six provisions include: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments. The index counts the number of antitakeover provision in place.	Bebchuk et al. (2009) & RiskMetrics
CEO ownership	The percentage stock ownership of the CEO.	ExecuComp
Ln(1 + CEO Delta)	The natural logarithm of one plus CEO Delta, defined as dollar change in wealth associated with a 1% change in the firm's stock price (in $000s).	Coles et al. (2006)
Ln(1 + CEO Vega)	The natural logarithm of one plus CEO Vega, defined as dollar change in wealth associated with a 0.01 change in the standard deviation of the firm's returns (in $000s).	Coles et al. (2006)
Four-Firm Concentration Ratio	The fraction of a 5-digit NAICS industry's sales accounted for by its largest four firms.	US Economic Consensus
Total number of external board seats by directors	Total number of external board seats held by all directors on the firm's board.	RiskMetrics
Total number of male external board seats	Total number of external board seats held by male directors on the firm's board.	RiskMetrics
Instruments		
Fraction of male directors linked to female directors	The fraction of male directors on the board who sit on other boards with at least one female director, following Adams and Ferreira (2009).	RiskMetrics
Female-to-male participation ratio	The female participation ratio divided by the male participation ratio for the state where the firm is headquartered. The female (male) participation ratio is measured as the percentage of the civilian non-institutional population of the female (male) group in the civilian labor force.	US Census Bureau

Appendix B. Correlation matrix

		V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
Dividend/TA	V1	1.00										
DPS/Share price	V2	0.63***	1.00									
Dividend per share (DPS)	V3	0.66***	0.78***	1.00								
Dividend/NI	V4	0.49***	0.54***	0.52***	1.00							
Dividend/Sales	V5	0.82***	0.68***	0.73***	0.52***	1.00						
Fraction of female dirs	V6	0.16***	0.21***	0.26***	0.13***	0.19***	1.00					
Fraction of female indep. dirs	V7	0.15***	0.21***	0.27***	0.13***	0.19***	0.92***	1.00				
Fraction of female execu. dirs	V8	0.036***	0.01	0.00	0.00	0.02*	0.28***	−0.01	1.00			
Fraction of male indep. dirs	V9	−0.01	0.03***	0.07***	0.02*	0.03***	−0.27***	−0.20***	−0.13***	1.00		
Leverage	V10	−0.02*	0.22***	0.20***	0.11***	0.12***	0.13***	0.14***	−0.04***	−0.01	1.00	
R&D/Sales	V11	−0.07***	−0.11***	−0.11***	−0.07***	−0.06***	−0.07***	−0.06***	−0.02*	0.03***	−0.10***	1.00
Tobin's q	V12	0.19***	−0.19***	−0.11***	−0.07***	0.07***	−0.02***	−0.03***	0.03***	−0.09***	−0.32***	0.15***
ROA	V13	0.29***	−0.01	0.07***	0.02*	0.15***	0.06***	0.04***	0.04***	−0.08***	−0.17***	−0.31***
Return volatility	V14	−0.09***	−0.20***	−0.23***	−0.15***	−0.16***	−0.16***	−0.17***	0.01	0.04***	−0.17***	0.26***
Cash/net assets	V15	−0.04***	−0.15***	−0.16***	−0.08***	−0.06***	−0.10***	−0.11***	0.04***	0.04***	−0.30***	0.36***
PPE/TA	V16	0.05***	0.23***	0.24***	0.15***	0.20***	0.05***	0.05***	−0.03***	−0.02*	0.32***	−0.14***
TA ($m)	V17	0.16***	0.24***	0.41***	0.16***	0.32***	0.24***	0.26***	−0.03***	0.04***	0.16***	−0.04***
Board size	V18	0.21***	0.31***	0.40***	0.21***	0.28***	0.31***	0.31***	0.00	−0.05***	0.28***	−0.09***
Fraction of independent dirs	V19	0.08***	0.15***	0.22***	0.09***	0.13***	0.25***	0.35***	−0.13***	0.85***	0.07***	−0.01
CEO Chairman	V20	0.07***	0.12***	0.19***	0.08***	0.10***	0.10***	0.12***	−0.03***	0.02*	0.10***	−0.06***
CEO tenure	V21	−0.05***	−0.09***	−0.11***	−0.07***	−0.08***	−0.15***	−0.17***	0.02***	−0.06***	−0.09***	0.00
E index	V22	−0.04***	0.06***	0.04***	0.02**	−0.02**	0.09***	0.13***	−0.08***	0.17***	0.11***	−0.04***

* Denotes statistical significance at the 10% level.

** Denotes statistical significance at the 5% level.

*** Denotes statistical significance at the 1% level.

Appendix B. (*continued*)

		V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22
Dividend/TA	V1											
DPS/Share price	V2											
Dividend per share (DPS)	V3											
Dividend/NI	V4											
Dividend/Sales	V5											
Fraction of female dirs	V6											
Fraction of female indep. dirs	V7											
Fraction of female execu. dirs	V8											
Fraction of male indep. dirs	V9											
Leverage	V10											
R&D/Sales	V11											
Tobin's q	V12	1.00										
ROA	V13	0.45***	1.00									
Return volatility	V14	0.17***	−0.14***	1.00								
Cash/net assets	V15	0.28***	−0.12***	0.27***	1.00							
PPE/TA	V16	−0.22***	0.08***	−0.11***	−0.30***	1.00						
TA ($m)	V17	−0.07***	−0.01	−0.12***	−0.11***	0.12***	1.00					
Board size	V18	−0.12***	0.02*	−0.24***	−0.25***	0.18***	0.45***	1.00				
Fraction of independent dirs	V19	−0.10***	−0.05***	−0.06***	−0.02*	0.01	0.18***	0.12***	1.00			
CEO Chairman	V20	−0.04***	0.02**	−0.09***	−0.09***	0.10***	0.14***	0.13***	0.08***	1.00		
CEO tenure	V21	0.03***	0.02**	0.01	0.07***	−0.05***	−0.09***	−0.14***	−0.15***	0.23***	1.00	
E index	V22	−0.15***	−0.07***	−0.10***	−0.10***	0.05***	−0.07***	0.12***	0.23***	0.05***	−0.10***	1.00

Appendix C. Robustness checks

This table contains a number of checks testing the robustness of the relationship between board gender composition and the dividend payout to alternative econometric estimation techniques, subsamples, and dividend variables. The alternative estimation techniques include OLS, Tobit, and Fama-MacBeth regressions based on the baseline model specification. Firm-clustered standard errors are used in the OLS and Tobit regressions and Newey-West robust standard errors are used in the Fama-MacBeth regressions. We check the robustness of our results when using subsamples excluding telecommunication and utilities firms, firms with female CEOs, and firms with female chairman CEOs. We test for possible non-linear effects of board gender composition on the dividend payout by including the squared term of board gender composition in the baseline OLS regressions. We also check the robustness of our results to controlling for CEO pay-performance sensitivity and to alternative dimensions of board diversity, including director age and tenure diversity. For each robustness check, we estimate the regressions separately for each of the five measures of dividend payments: the dividend payout, dividends to total assets, dividend yield, dividend per share and dividends to total sales. The same set of control variables, industry and year effects as in our baseline regressions are included. For brevity, we only report the coefficients on the *Fraction of female dirs*.

	Dividend/NI	Dividend/TA	Dividend yield	Dividends per share	Dividend/Sales
OLS regressions ($N = 12{,}050$)					
Fraction of female dirs$_{t-1}$	0.167**	0.011***	0.013***	0.370***	0.009**
	(0.069)	(0.004)	(0.003)	(0.105)	(0.005)
Tobit regressions ($N = 12{,}050$)					
Fraction of female dirs$_{t-1}$	0.474***	0.024***	0.024***	0.714***	0.023***
	(0.131)	(0.006)	(0.005)	(0.165)	(0.007)
Fama MacBeth regressions ($N = 12{,}050$)					
Fraction of female dirs$_{t-1}$	0.234**	0.014***	0.014***	0.434***	0.012**
	(0.079)	(0.003)	(0.003)	(0.102)	(0.004)
Excluding telecom and utilities ($N = 10{,}867$)					
Fraction of female dirs$_{t-1}$	0.123**	0.011**	0.011***	0.366***	0.009*
	(0.062)	(0.004)	(0.003)	(0.106)	(0.005)
Excluding observations with female CEOs ($N = 11{,}793$)					
Fraction of female dirs$_{t-1}$	0.148**	0.010**	0.011***	0.363***	0.009*
	(0.065)	(0.004)	(0.003)	(0.107)	(0.005)
Excluding observations with female chairman CEOs ($N = 11{,}912$)					
Fraction of female dirs$_{t-1}$	0.132**	0.009**	0.011***	0.351***	0.009*
	(0.064)	(0.004)	(0.003)	(0.104)	(0.005)
Non-linearity ($N = 12{,}050$)					
Fraction of female dirs$_{t-1}$	0.343**	0.018**	0.023***	0.791***	0.018*
	(0.151)	(0.009)	(0.007)	(0.207)	(0.010)
Squared fraction of female dirs$_{t-1}$	−0.619	−0.025	−0.037	−1.483**	−0.013
	(0.531)	(0.029)	(0.023)	(0.628)	(0.031)
Controlling for ln(1 + *CEO Delta*) *and* ln(1 + *CEO Vega*)					
Fraction of female dirs$_{t-1}$	0.142*	0.010***	0.011***	0.335***	0.009*
	(0.073)	(0.004)	(0.003)	(0.104)	(0.005)
Controlling for Board age, Age diversity, Board tenure and Tenure diversity					
Fraction of female dirs$_{t-1}$	0.144**	0.012***	0.012***	0.290***	0.006
	(0.066)	(0.004)	(0.003)	(0.109)	(0.005)

* Denotes statistical significance at the 10% level. ** Denotes statistical significance at the 5% level. *** Denotes statistical significance at the 1% level.

Appendix D. IV regressions with additional controls

Dependent variables	1st stage Fraction of female dirs. (1)	2nd stage Dividend/NI (2)	1st stage Fraction of female dirs. (3)	2nd stage Dividend/NI (4)
Intercept	−0.096***	0.382	−0.158***	0.357*
	(0.035)	(0.235)	(0.034)	(0.215)
Fraction of male directors linked to female dirs$_{t-1}$	0.056***	–	0.110***	–
	(0.011)		(0.010)	
Fraction of female dirs$_{t-1}$	–	1.953***	–	1.147***
		(0.707)		(0.335)
Total external board seats$_{t-1}$	−0.001**	0.001	–	–
	(0.000)	(0.001)		
Male external board seats$_{t-1}$	–	–	−0.005***	0.004**
			(0.000)	(0.002)
Leverage$_{t-1}$	0.003	−0.094**	0.004	−0.093**
	(0.011)	(0.047)	(0.011)	(0.044)
R&D/Sales$_{t-1}$	−0.005	−0.011	−0.005	−0.015
	(0.004)	(0.026)	(0.005)	(0.026)
Tobin's q$_{t-1}$	0.001	−0.004	0.001	−0.004
	(0.001)	(0.005)	(0.001)	(0.004)
ROA$_{t-1}$	0.021	0.079	0.014	0.103
	(0.020)	(0.076)	(0.019)	(0.067)

(continued)

Dependent variables	1st stage Fraction of female dirs. (1)	2nd stage Dividend/NI (2)	1st stage Fraction of female dirs. (3)	2nd stage Dividend/NI (4)
Cash/net assets$_{t-1}$	0.004	0.022	0.005	0.025*
	(0.003)	(0.015)	(0.003)	(0.015)
PPE/TA$_{t-1}$	−0.006	0.078	−0.009	0.075
	(0.012)	(0.048)	(0.011)	(0.046)
Return volatility$_{t-1}$	−0.055	−0.568***	−0.044	−0.620***
	(0.040)	(0.157)	(0.038)	(0.140)
Ln (TA)$_{t-1}$	0.008***	−0.016*	0.010***	−0.012
	(0.002)	(0.010)	(0.002)	(0.008)
Board size$_{t-1}$	0.006***	0.008	0.009***	0.011**
	(0.001)	(0.005)	(0.001)	(0.004)
Fraction of independent directors$_{t-1}$	0.074***	−0.055	0.081***	−0.002
	(0.012)	(0.073)	(0.011)	(0.051)
CEO Chairman$_{t-1}$	0.011***	0.003	0.010***	0.012
	(0.003)	(0.016)	(0.003)	(0.013)
CEO tenure$_{t-1}$	−0.001***	0.000	−0.001***	−0.000
	(0.000)	(0.001)	(0.000)	(0.001)
E index$_{t-1}$	0.002	−0.014**	0.001	−0.012**
	(0.001)	(0.006)	(0.001)	(0.005)
Industry effects	Y	Y	Y	Y
Year effects	Y	Y	Y	Y
N	11,860	11,860	11,860	11,860
Adjusted R^2	0.289	0.042	0.321	0.108
F-statistic	28.500***	–	122.350***	–
Obs.	11,860	–	11,860	–
CD Wald F-statistic	133.570	–	532.060	–

* Denotes statistical significance at the 10% level. ** Denotes statistical significance at the 5% level. *** Denotes statistical significance at the 1% level.

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